Green Roofs: Stormwater Management and Urban Heat Island Mitigation

Slide 1: Title Slide

Neelam Patel: So we have Jason Berner from EPA's Office of Water, Office of Science and Technology on the call today. Most recently, Jason has been working on developing a draft for the stormwater mitigation rule which looks at modeling – stormwater benefits of low impact development. And one of these benefits includes Heat Island mitigation, but what we'd like to do is focus in on the stormwater benefits of green roofs which we know is a concern for many local-level governments. Jason?

Slide 2: Jason Berner

Jason Berner: All right, thank you. So this first slide, I'm going to sort of skip over since we did that introduction.

Slide 3: Outline

Jason Berner: So my presentation, I'm going to cover on the impacts of stormwater runoff and some of the benefits that can be accrued from green roofs, and looking at different applications of green roofs, and how they can be used for stormwater mitigation, and some analytic and design tools for green roofs.

Neelam Patel: Jason, this is Neelam. Could you make your presentation full screen?

Jason Berner: Yes, sorry about that.

Neelam Patel: No problem.

Jason Berner: Is that better?

Neelam Patel: Yes.

Slide 4: Water Quantity Impacts: Changes in Land-Water Linkages

Jason Berner: OK, great. OK. Yes, so with stormwater management, one of the things that EPA looks at in how the stormwater discharges increase with urban development is how land uses are changed by what is the natural ground cover to the amounts of impervious surface that increases with urban development, as you go from what would be perhaps a forested area to low density residential to medium density to what would be like an ultra urban environment.

So as the amount of development increases, which is the same as the amount of impervious surface cover increases, you have less of the natural hydrologic cycle taking place, so you have less evapotranspiration from vegetation and the amounts of infiltration of precipitation into the

landscape. And as developments or impervious surface increases over the landscape for a given watershed, you're going to have increases in the amounts of stormwater discharges that go into your streams, lakes and other water bodies. And as that occurs, there are different types of environmental degradation that occur, including channelization of streams and increases in nutrient loads and heavy metal.

Slide 5: Green Roof Overview

Jason Berner: So, just a quick overview of green roofs, when we talked about how they can enhance or restore what the natural hydrologic cycle was on the landscape before developments occurred and with – and how that happens you're – essentially, you're replacing what would be conventional roof tops or impervious surfaces with different types of vegetation and soil media that can retain certain size storm events. In D.C. some of the small storm events can be from .25 to .5 inches. And another related thing is that by having the green roof on the buildings, you can have differences in the amounts or the temperatures on the outside of buildings.

Slide 6: Types of Green Roofs

Jason Berner: This is just a quick recap of what are the types of green roofs. So you have extensive and intensive and there are also hybrid green roofs where you're mixing the extensive and intensive green roof materials.

Slide 7: Applications of Green Roofs

Jason Berner: OK, so where can we put green roofs? Well, almost anywhere where you want to, but some of the places that we look at for stormwater program is where can they – where, with new development, redeveloped sites, or retrofitting existing buildings.

Slide 8: Benefits of Green Roofs

Jason Berner: And then when we look at the benefits of green roofs from a stormwater standpoint, we're wanting to know what are the overall reductions in flow in the volume of stormwater that go into your streams or lakes, other water bodies and then what are the associated reductions in pollution loads, such as nitrogen or phosphorus. And when you have different types of vegetation on green roofs, you are increasing the local site biodiversity, so you're increasing habitat for different species. Another benefit by having a green roof is that it allows stakeholders or people that use the buildings to know more about how water is managed on their site so they care a little bit more than when it just goes to storm drain.

Slide 9: Benefits of Green Roofs

Jason Berner: Couple of other benefits, maybe a little less stormwater-related but still important is that you can increase the aesthetic appeal of the property with a green roof. You can have less maintenance cost or replacement cost compared to conventional roofs and there are some incentive programs or tax incentives where stormwater utility fees can be waived if you have less impervious surfaces for a given building.

Slide 10: Examples of Green Roofs

Jason Berner: So I'm going to show a couple of examples of green roofs in the country. This first one is of the American Society of Landscape Architects in Washington D.C., which is a commercial retrofit. And this is sort of a cool example in that they were trying to figure out, you know, different ways that they could use an extensive and intensive green roof and they were monitoring the differences in temperature from their buildings to surrounding buildings and also recording the amounts of precipitation that was retained for a given summer to fall period. So for one period of record, they found out that they were able to retain about 76 percent of the amount of rain from the summer to fall season.

Slide 11: Examples of Green Roofs

Jason Berner: This next example, I'm not going to talk about this too much because we'll go into it in more depth. But this green roof at City Hall of Chicago is pretty important in that it was one of the first major retrofits for an institutional building or any building in the U.S. And they looked at the – they looked at using 150 different species of plants and they recorded that this green roof was able to retain 75 percent of a one inch rain event which is – for most areas one inch rain events can cover between 85 to 90 percent of all rain events throughout a given year.

Slide 12: Examples of Green Roofs

Jason Berner: OK. And this last example that I have, this is more of like an urban planning view of or a regional view of how you can plan out, how green roofs are implemented for Washington, D.C. This is Casey Trees and LimnoTech did this D.C. green build-out model and they looked at different scenarios of how intensively they could use green roofs, and also a tree canopy to catch our stormwater runoff. And they looked at – they looked at it at different time periods and found out that there could be up to a 10 percent reduction in stormwater runoff in Washington D.C.

Slide 13: Tools & Resources for Green Roofs

Jason Berner: The last couple of slides, I'm going to talk about tools for designing green roofs and also modeling them. Green Roofs for Healthy Cities, that's an industry website that you can get up-to-date publications and look at what conferences are going on or trainings. And then EPA, we have a couple of websites where you can look at not only green roofs for their performance and different design templates, but you can also look at rain gardens or porous pavements. So, there's a suite of what we call BMPs that can be integrated with green roofs.

Slide 14: Tools & Resources for Green Roofs

Jason Berner: And this next slide, this gets into more of the models that we use for assessing the benefits of using green roofs. So there is the EPA SWMM model and a newer model which is called SUSTAIN. And SUSTAIN is a GIS-based version of SWMM, and you can design from a one acre or smaller parcel of land up to – at the neighborhood scale and see how you could use

green roofs, but also other BMPs to see how you could reduce pollutant loadings and the amount of stormwater coming off of a given site.

Lastly, there're some stormwater calculators, which are simple versions of some of the EPA models, where you can figure out conceptually like how much – if I did a green roof of a certain size for a given parcel of land, what would be the general reductions in stormwater runoff and general reductions in nutrients. Virginia – State of Virginia has a spreadsheet called the Virginia Runoff Reduction Method, where they're looking at primarily how they can reduce nutrients to the Chesapeake Bay with different green BMPs such as green roofs.

Slide 15: Thank You, Questions??

Jason Berner: And that's all for me. That is my contact information and we have a website where you can keep up to date with the stormwater rule that we're currently working on. We're looking primarily at green infrastructure and low impact development design technology such as green roofs for that rule.

Neelam Patel: Great. Thank you, Jason. That was a great overview of the stormwater perspective on green roofs. And again, if you have questions for David or Jason, feel free to email them or submit them to us, using go to meeting, and we'll answer them during the question and answer session.